Space Weather Technical Forecast

Issued on Thursday, 30 June 2022 at 01:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Active electron fluence continuing. Slight chance of M-class flares.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been Low over the past 24 hours, with a C1.4 flare at 29/23123 UTC. There are three sunspot regions on the visible disc. AR3040 remains the largest region, although it remains largely inactive. It has simplified a little magnetically. The group is now considered as Cao/Beta. AR3042 and a new region in the southeast are both weak and stable bi-polar regions.
No Earth-directed CMEs were observed in available imagery.
Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by DSCOVR and ACE at L1, was elevated at first, around 520 km/s, but has eased to slightly elevated levels around 440km/s as the influence from a coronal hole high speed stream subsided. Density was mainly average or below average. The Phi angle was predominately negative (towards the Sun) or neutral. The total Interplanetary Magnetic Field (IMF) was weak and below 6nT, the North-South component, Bz, fluctuating between +6/-4nT. The resulting geomagnetic activity was largely Quiet (Kp1-2).
Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) as measured by GOES16 remained at Background levels throughout the period. The High energy electron flux (greater than 2MeV) was High from 29/0935UTC, peaking at 3490 pfu at 29/1610 UTC. The corresponding 24-hour electron fluence remained above the Active threshold (1e8 integrated pfu), but slowly declined through the period. An observed fluence of 1.61e8 integrated pfu was recorded at 30/0000 UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is likely to be Low, with only a slight chance of isolated M-class flares.
Solar Wind / Geomagnetic Activity: A very slow CME which left the Sun on the 26th June may arrive at Earth on the 2nd July (Day 3). No other earth-directed CMEs currently feature in the forecast. Solar winds are expected to ease towards slow-ambient levels, with no significant enhancements expected during the rest of the period. Geomagnetic activity is expected to be mainly Quiet with isolated Unsettled intervals.
Energetic Particles / Solar Radiation: In the absence of any significant sunspot development, the High energy proton flux (greater than 10 MeV) is expected to remain at Background levels. The high energy electron flux (greater than 2 MeV) is expected to continue fluctuating between Moderate and High until at least Day 2 (1st July), followed by a drop in electron flux to more persistently Moderate or Background levels. Corresponding electron fluence is expected to remain above the Active (1e8 integrated pfu) fluence level until at least Day 2 (1st July). After this it may lower to Moderate levels, though confidence in the timing of this occurring is not high.

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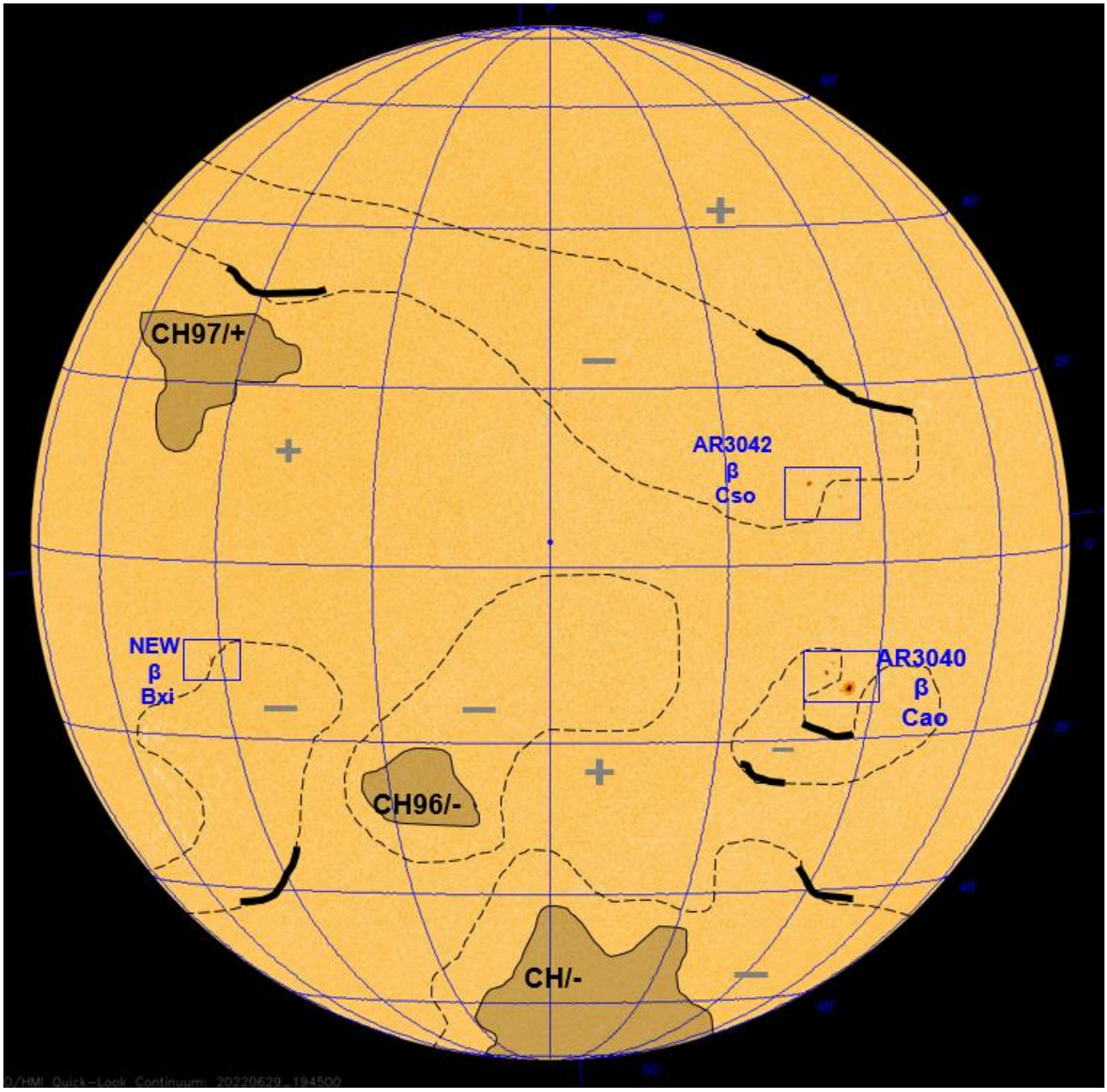
Figure 1. Solar Analysis Valid 29/2000UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

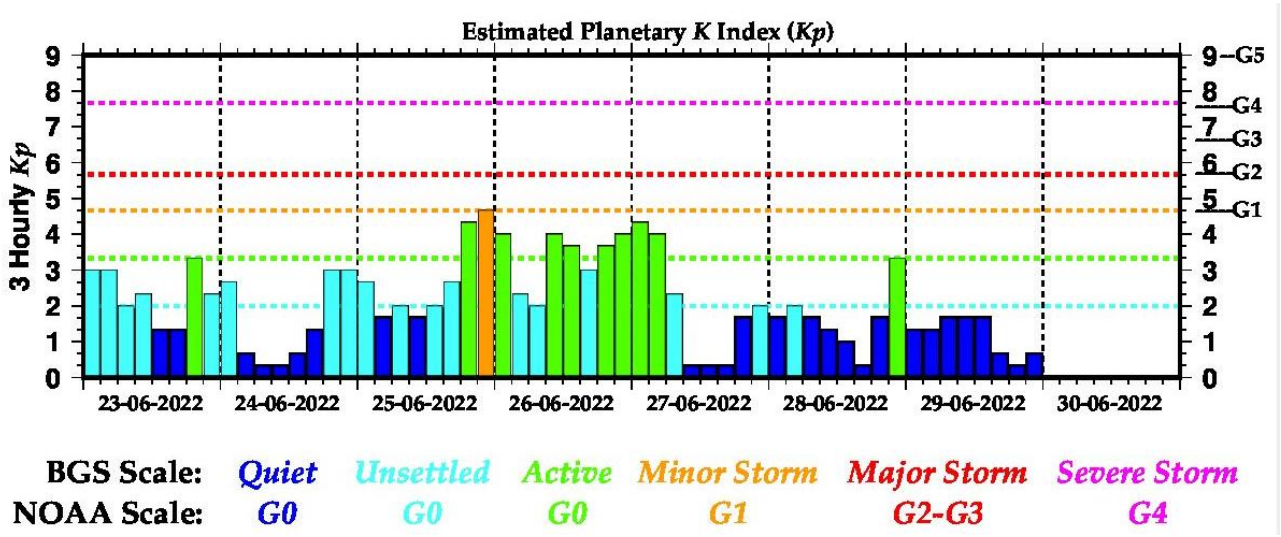
A CME which left the Sun on the 26th may arrive at Earth on the 2nd July (Day 3). However its velocity is estimated to be slow, so much so that it will most certainly be unnoticed when reaching the Earth, merging with the background solar wind. Little if no impact on the geomagnetic activity. Another CME was observed leaving the sun at around 28/2200 UTC, this time originating from a filament lift-off in the northern centre disc. The results of the analysis are not fully known yet but it is considered to be slow and to arrive at Earth beyond the validity period of this forecast, most likely on Day 5 (4th July). No other earth-directed CMEs currently feature in the forecast.

The solar wind has recently started to decline otherwise, currently around 440km/s, as the connection with the HSS originating from CH93/- and CH94/- subsides. With no other coronal features visible in the western hemisphere, solar winds should continue to ease towards slow-ambient levels, as suggested by the Solar Wind Persistence Model. Geomagnetic activity is expected to be mainly Quiet with isolated Unsettled intervals.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections- Nil

Figure 2: BGS Kp all Quiet on the 29th June


Estimated Planetary K Index (Kp)
3 Hourly Kp
9 8 7 6 5 4 3 2 1 0
G5 G4 G3 G2 G1
23-06-2022 24-06-2022 25-06-2022 26-06-2022 27-06-2022 28-06-2022 29-06-2022 30-06-2022
BGS Scale: Quiet Unsettled Active Minor Storm Major Storm Severe Storm
NOAA Scale: G0 G0 G0 G1 G2-G3 G4

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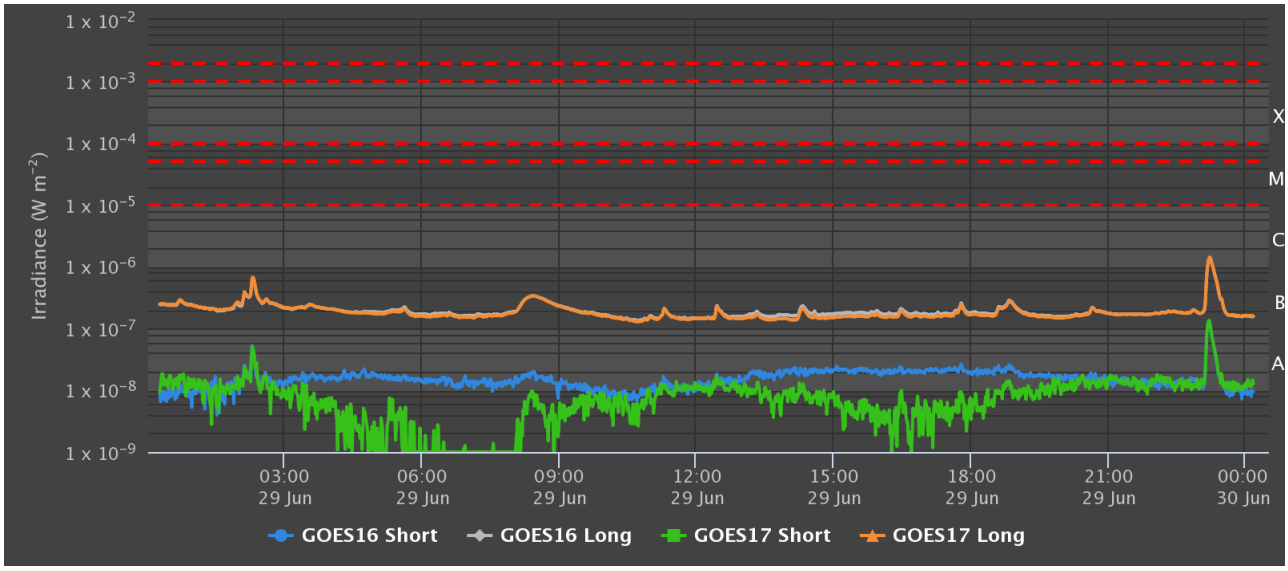
Radio Blackouts - X-Ray Flares:
Solar activity has been Very Low over the past 24 hours, with no significant flares observed. There are three sunspot regions on the visible disc. AR3040 remains the largest region but remains largely inactive and has undergone some magnetic simplification. The group is now considered as Cao/Beta. AR3042 and the NEW region in the southeast are both small, weak, bi-polar regions.
Activity is expected to remain Low or Very Low, with only a slight chance of isolated M-flares.

A bright flux region is visible on STEREO-EUVI imagery (around N20 E110), perhaps indicating the presence of an active region. This would be expected to rotate onto the Earth-facing disc on Day 2 (1st July).

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	10	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES16 X-Ray flares shows just the one C (C1.4) flare.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels, and will most likely remain at this level through the period, in the absence of any significant sunspot development.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The High energy electron flux (greater than 2 MeV) was High from 29/0935 UTC, peaking at 3490 pfu at 29/1610 UTC.

Electron flux levels are expected to continue fluctuating between Moderate and High until at least Day 2 (1st July). Beyond that, a drop in electron flux to more persistently Moderate or Background levels appears more probable.
Corresponding electron fluence is expected to remain above the Active (1e8 integrated pfu) fluence level until at least Day 2 (1st July). After this it may lower to Moderate levels, though confidence in the timing of this occurring is not high. Active levels of fluence were observed around 24 hours later than standard 27-day persistence had indicated, though this and the REFM forecast indicate fluence levels remaining above the Active threshold well into Day 2. This gives added confidence to the current forecast.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	70	50	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	5	1	1	1

Figure 4: GOES16 ElectronFlux above 1000pfu High level for much of the 29th.

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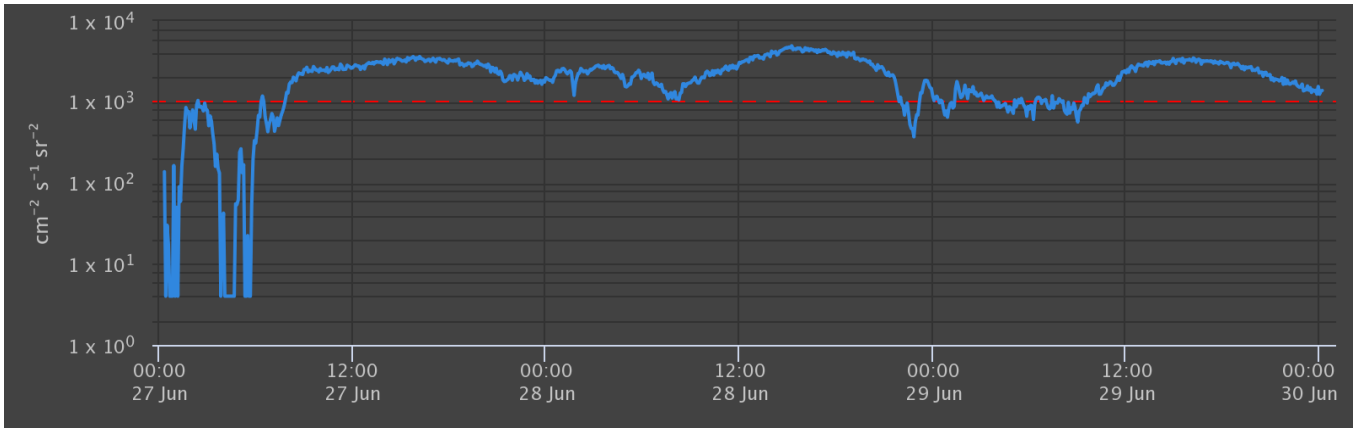
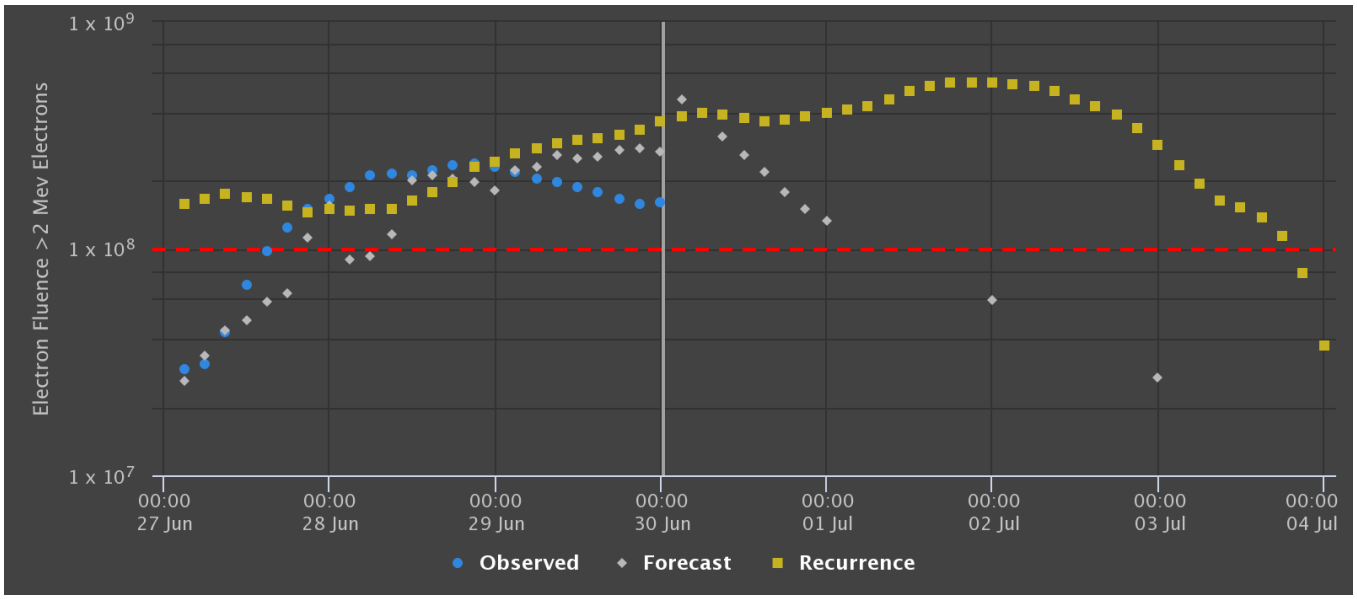


Figure 5: MOSWOC REF Model suggests a downward trend with integrated fluence levels which is accepted.



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